

THE CLAIMS:

1. A method of machining a carbon-containing work piece, the method comprising:

using at least one electrode to perform electrical discharge machining of the carbon-containing work piece, the electrode made of a material that is mechanically and chemically compatible with the carbon-containing work piece.

2. The method of claim 1, wherein an outer surface of the electrode is formed by a carbon-based material.

3. The method of claim 1, wherein the electrode is made of a material selected from a group consisting of carbide, graphite, carbon and tungsten.

4. The method of claim 1, wherein the electrode includes a metal body and a mechanically and chemically compatible coating on the body.

5. The method of claim 1, wherein at least one electrode is scanned across the work piece to machine different features.

6. The method of claim 1, wherein arrays of the electrodes are used to machine different features in the work piece.

7. The method of claim 1, wherein the electrode has a shape of a portion to be removed from the work piece.

8. The method of claim 1, further comprising the step of causing local surface oxidation of the work piece during machining.

9. The method of claim 8, wherein the local oxidation is caused by supplying an oxidizing dielectric to the work piece.

10. The method of claim 8, wherein the electrode is used to direct a dielectric onto the work piece to cause local surface oxidation.

11. The method of claim 1, wherein the work piece is a Carbon-Carbon work piece.

12. The method of claim 11, wherein the work piece is partially densified prior to machining, the method further comprising the step of fully densifying the work piece after machining.

13. The method of claim 12, wherein the work piece is machined into a heat exchanger core.

14. The method of claim 11, wherein the work piece is fully densified prior to machining, wherein the machining is started with an oxidizing dielectric; and wherein the machining is finished with a hydrocarbon dielectric.

15. The method of claim 14, wherein the work piece is machined into a bipolar plate of a proton exchange membrane fuel cell.

16. A method of machining a Carbon-Carbon work piece, the method comprising:
using an electrode to perform electrical discharge machining of the Carbon-Carbon work piece, the electrode made of a material selected from a group consisting of carbide, graphite, carbon and tungsten; and causing local surface oxidation of the work piece during machining

17. A Carbon-Carbon work piece comprising machined features having dimensions between 0.1 millimeters and 1 millimeter.

18. The work piece of claim 17, wherein the work piece is a heat exchanger core; and wherein the machined features are fluid passageways extending through the heat exchanger core.

19. The work piece of claim 17, wherein the work piece is a bipolar plate for proton exchange membrane fuel cells; and wherein the machined features are flow fields.

20. An electrode comprising:
a body made of a material that is chemically and mechanically compatible with a carbon composite; and
a fluid passageway in the body.

21. The electrode of claim 20, wherein the electrode is used to remove a portion of a work piece; and wherein the body has a shape of the portion to be removed from work piece.

22. The electrode of claim 20, wherein the body is made of a material selected from a group consisting of carbide, graphite, carbon and tungsten.

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23. The electrode of claim 20, wherein the fluid passageway is an enclosed passageway.

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